

Factsheet 3/4 The ET Landfill Cover

Alternative landfill covers

Alternative landfill covers that use simpler and more natural components including soils and plants are coming into use. Both state and federal regulatory personnel recognize the value of these new covers (1, 2).

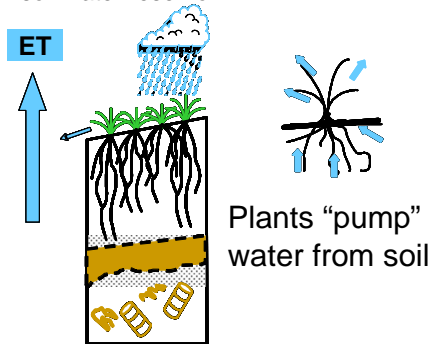
Alternative landfill covers are accepted.



The evapotranspiration (ET) landfill cover

In its simplest form, the ET cover consists of a layer of soil covered by native grasses. The soil contains no barrier or impermeable layers and uses two natural processes to control infiltration:

1. The uncompacted soil provides a water reservoir.
2. The natural mechanism of ET empties the soil water reservoir.



The soil cover stores the rainfall that infiltrates into the soil until the ET process removes it. The combination of evaporation from the soil surface and plant transpiration (ET) empties the soil water reservoir for another cycle.

The ET cover is a relatively inexpensive, practical, and easily maintained biological system that will remain effective over extended periods of time—perhaps centuries—at low cost. The technology was developed and tested within the agricultural engineering and science professions over several decades.

How does the ET cover differ from a conventional landfill cover?

A conventional landfill cover is based upon the barrier concept—a physical “impermeable” layer is placed between surface soil and the waste. This barrier typically employs a material having low hydraulic conductivity, such as compacted clay, a synthetic membrane, or a combination of the two. The barrier concept inherently opposes the forces of nature, therefore it tends toward failure.

The ET cover utilizes natural processes of absorption and evapotranspiration. Use of a suitable soil for the cover allows the soil to hold infiltrating precipitation until removed by native grasses growing on the surface. Because the ET cover relies on these natural, self-renewing processes, it will remain effective indefinitely. There are no barriers to maintain.

What evidence exists that the ET cover will work?

Perhaps the most important requirement for a successful cover is its ability to limit the vertical movement of water, thus reducing or preventing the transport of contaminants from the landfill into groundwater. There is persuasive and substantial scientific evidence that—when correctly designed and constructed—the innovative and less costly ET cover can control the amount of precipitation that infiltrates into landfill wastes and thereby meet environmental requirements (3).

ET cover requirements

ET covers require soil with adequate water holding capacity to meet the requirements of the site. An important requirement is the establishment and maintenance of

Some vegetated covers do not meet the requirements for ET covers.

native grasses or other dominant native plants on the surface of the cover to quickly remove soil water and protect the cover from soil erosion. An important requirement of the soil is that its soil strength should be low in order to allow robust and rapid root growth which is essential to success of the ET cover. Low soil strength is usually assured by maintaining low soil density during and after construction. It is important that the soil density should be less than 1.5 Mg/m³. Some existing vegetated and alternative landfill covers have high soil density and do not meet the requirements for an ET cover.

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How do construction costs for an ET cover compare to those for a conventional cover system?

Construction costs for the ET cover depend primarily on the thickness of the cover required to prevent or minimize deep percolation into the waste. This, in turn, is dependent upon site-specific conditions such as the climate and the characteristics of locally available soils. The per-acre costs will be different for each site. However, our estimate is that the cost of an ET cover will generally not exceed half the cost of a conventional landfill cover.

Construction costs - about half

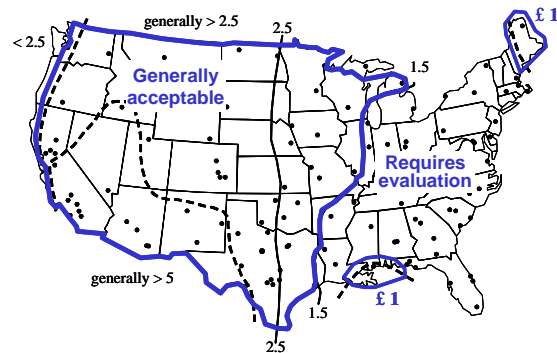
Are engineering design tools available?

The normal engineering design tools are applicable to ET cover design with one exception. Hydrologic design of the ET cover water balance requires a model with good plant-soil-evaporation properties. We recently evaluated models and found that hydrologic performance can be accurately estimated with the EPIC model (4, h).

Where can ET covers be used?

Plants, soil, and variations in climate interact to affect the performance of the ET cover. Therefore, its use should be evaluated on a site-specific basis. Our evaluation (4, f) revealed that the ET cover is applicable at 93% of the sites evaluated in the USA mainland, and doubtful at 7% of them. Exceptions are wet and cold coastal areas, extremely wet climates, high-altitude locations, and very cold sites with long winters.

Sites in the wetter, more humid eastern USA are not excluded from the potentially successful applications of the ET cover, but they require an assessment of potential at each site. The map below shows the distribution of the ratio of potential ET with precipitation (4, f).



Applicable – 93% Doubtful – 7%

Where can I learn more about the ET cover?

As a nonprofit organization, Mitretek Systems has developed and evaluated the ET cover. Technical information is available in the references shown below or information can be obtained directly from:

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References

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- (2) ITRC, 2003. *Technical and regulatory guidance for design, installation, and monitoring of alternative final landfill covers*. Interstate Technology & Regulatory Council (ITRC), Alternative Landfill Technologies Team. Available at: <http://www.itrcweb.org/common/default.asp>.
- (3) Hauser, V. L., B. L. Weand, and M. D. Gill, 2001. *Natural covers for landfills and buried waste*. American Society of Civil Engineers, Jour. Environmental Engineering, vol. 127, no. 9; 768-775.
- (4) Technical references on ET landfill covers - available from the Air Force Center for Environmental Excellence (AFCEE), at: <http://www.afcee.brooks.af.mil/products/techtrans/landfillcovers/default.asp>.
 - a. 1999. *Landfill Covers for Use At Air Force Installations*
 - b. 1999. *Survey of Air Force Landfills, Their Characteristics, and Remediation Strategies* (includes database)
 - c. 1999. *Decision Tool for Landfill Remediation*
 - d. 1999. *Landfill Remediation Project Managers Handbook*
 - e. 2000. *Golf Courses on Air Force Landfills*
 - f. 2001. *Vegetated Landfill Covers and Phytostabilization— The Potential for Evapotranspiration-based Remediation at Air Force Bases*
 - g. 2001. *Alternative Landfill Covers (for ITRC landfill summit)*
 - h. 2004. *Evaluating Evapotranspiration (ET) Landfill Cover Performance Using Hydrologic Models*